

On the Present State of M. Delaunay's Investigations on the Lunar Theory. By Professor Simon Newcomb.*(From a letter to Warren De La Rue, Esq.)*

I have lately seen, in an unofficial report of the proceedings of one of the meetings of the Royal Astronomical Society last winter or spring, that you inquired with much interest after Delaunay's investigations of the lunar theory. Being in possession of the information, I take the liberty of answering your questions—a liberty I hope you will excuse.

Delaunay's two published volumes form a substantially complete work, so far as the problem of three bodies is concerned. It remains only to add the terms due to the motion of the Earth round the common centre of gravity of the Earth and Moon, which is a simple matter.

In the preface to the second volume, Delaunay promised a third volume, to contain the investigation of the other actions to which the Moon was subjected, in the spring of 1871. I learned from him that he had done substantially nothing towards preparing this volume, except to compute the secular acceleration. The result of this was published in the *Comptes Rendus*. He was so much occupied with observatory management during the remainder of his life, that I feel confident he did little or nothing in addition.

Last summer all his theoretical investigations were at the Observatory of Paris in charge of M. Loewy, who was desirous of continuing them. So far as the perturbations due to the action of the Sun were concerned, his tables were completed in 1871. It remains not only to finish the supplementary researches and tabulate the results, but to investigate the lunar elements, and to form the arguments of the tables. This work had not then been taken into consideration, and so far as I know was not commenced at all before his lamented death.

Washington.

1874, September 28.

Relations between the Motions of some of the Minor Planets.

By Professor Kirkwood, of Bloomington, Indiana.

(From a Letter to R. A. Proctor, Esq.)

If your theory of planetary accretion be true the zone of asteroids must probably furnish instances of special relations between the mean motions of its different members. I refer to such relations as those found by Laplace between *Jupiter's* first three satellites. Soon after your brief visit to Bloomington in March, I commenced collating the mean motions of certain members of the group with those of *Jupiter* and *Saturn*. The

research has already been crowned with success. My results, in part, are as follow :—

Let n^V , n^{VI} , represent the mean motions of *Jupiter* and *Saturn*;

$n^{(50)}$, $n^{(78)}$, &c., those of *Pales*, *Diana*, &c.; the numerals in parentheses denoting the minor planets in their order of discovery;

Let also $L^{(50)}$, $L^{(78)}$, &c., represent the mean longitudes at a given epoch; then

$$n^{(50)} - 3n^{(78)} + 2n^{(11)} = 0 \quad . \quad . \quad . \quad (1),$$

$$L^{(50)} - 3L^{(78)} + 2L^{(11)} = 180^\circ \quad . \quad . \quad . \quad (2).$$

The exact similarity of these equations to those of Laplace, referred to above, is at once apparent. The origin of the relation, whether we accept the nebular hypothesis or your own theory recently announced, may be accounted for as in Note VII., vol. II. of Laplace's *System of the World*.

But were the relations expressed by (1) and (2) rendered rigorously exact by the mutual attraction of *Pales*, *Diana*, and *Parthenope*? This, to myself, seems wholly improbable. The required explanation is to be looked for in the perturbing influence of *Jupiter* and *Saturn*. A comparison of mean motions gives the following equations :—

$$2n^{(11)} - 9n^V + 7n^{VI} = 0 \quad . \quad . \quad . \quad (3),$$

$$n^{(50)} - 3n^V + 2n^{VI} = 0 \quad . \quad . \quad . \quad (4),$$

$$n^{(78)} - 4n^V + 3n^{VI} = 0 \quad . \quad . \quad . \quad (5).$$

Eliminating n^V and n^{VI} from (3), (4), and (5), we obtain equation (1).

Other results have been reached, which will probably soon be published.

Bloomington, Indiana,
1874, June 22.

Note on the Zodiacal Light. By John I. Plummer, Esq.

(Communicated by E. Dunkin, Esq., Hon. Secretary.)

Having been engaged observing Comet III. 1874 (Coggia's) upon several occasions during the early morning hours in the present and preceding months, I have not failed to notice repeated brilliant exhibitions of the Zodiacal Light. Upon seven mornings it has been very conspicuous indeed, more than rivalling the brightness of the Milky Way, namely, on September 17, 19, 21, 22, October 9, 19 and 21,* at hours varying from 14^h 15^m in the former month, to 16^h 0^m in the latter. On October 10 it was invisible only in consequence of a general phosphorescent state

* P.S.—To these dates may now be added November 7, when the Zodiacal Light was unmistakably seen, though less bright than on the above-mentioned date.